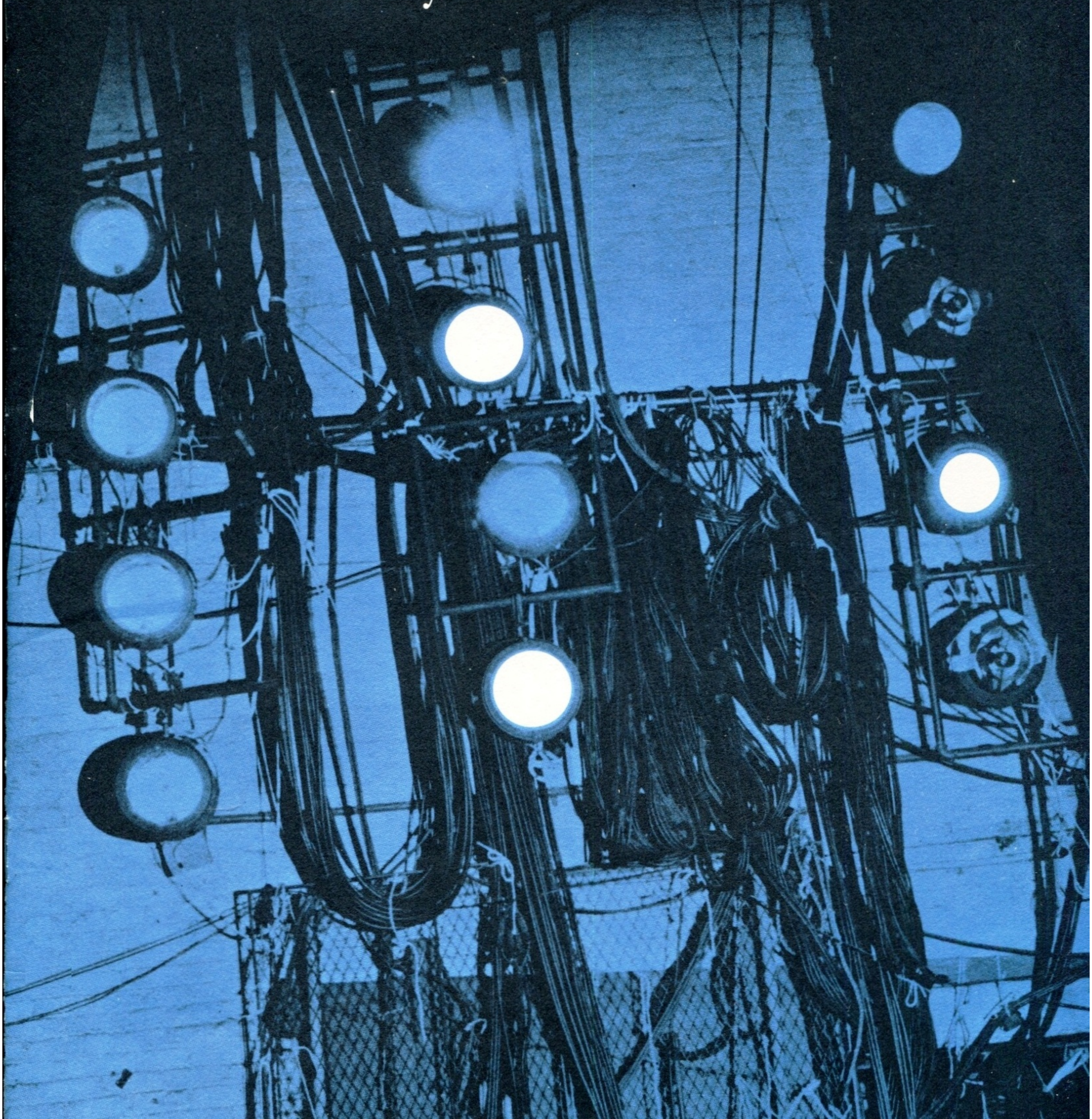
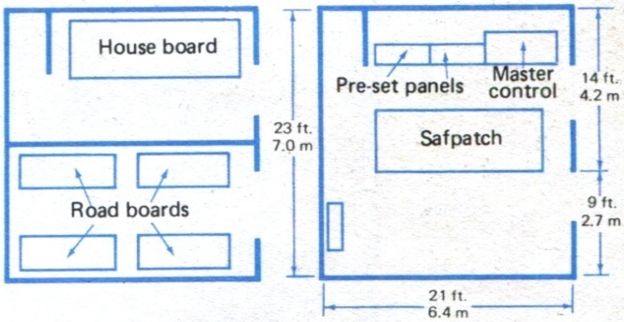
INNOVATIONS IN LIGHTING CONTROL

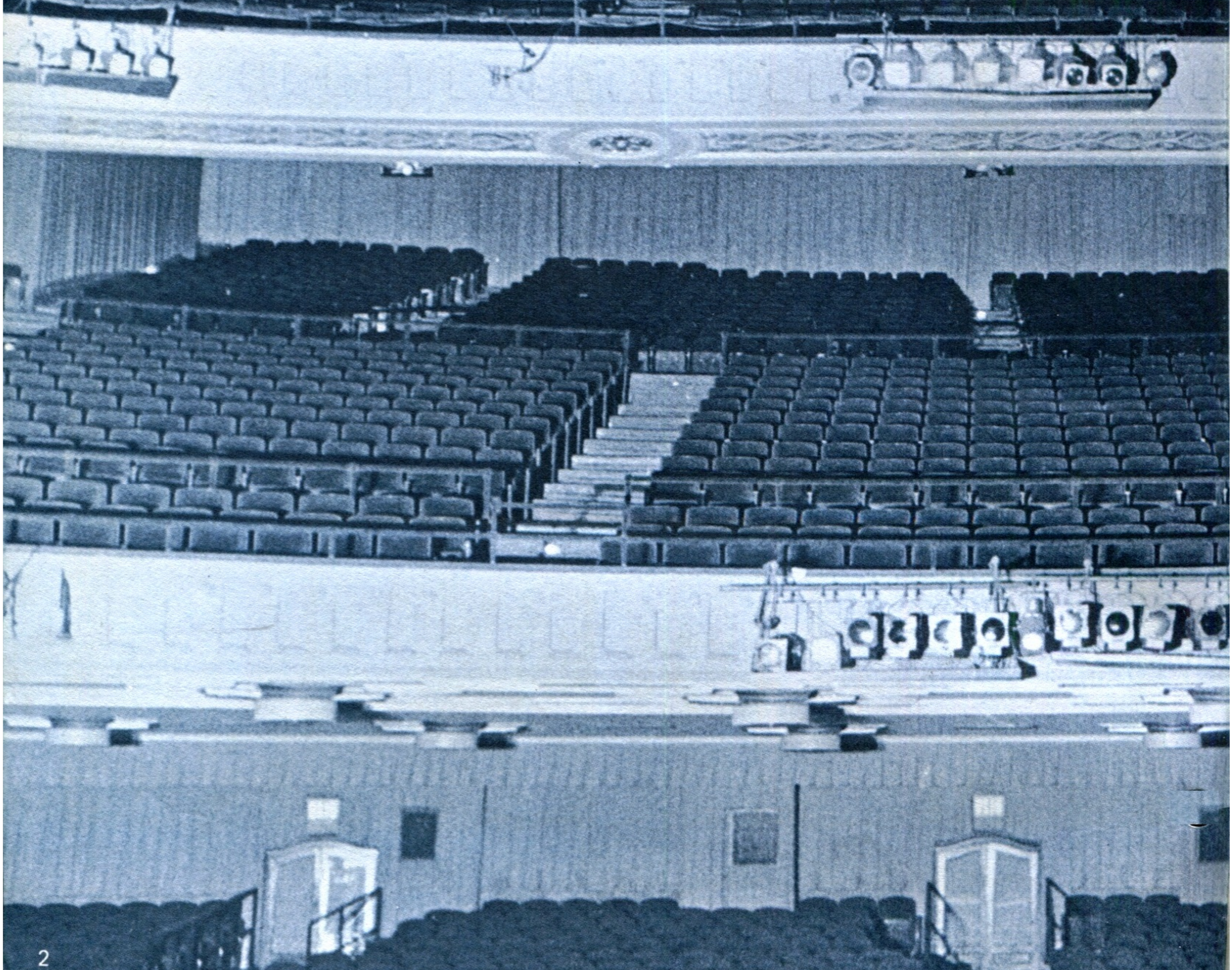
How Kliegl Brothers renovated the lighting control systems at the New York City Center



OLD: The old resistance dimming equipment occupied all the available space at stage left in the City Center. The two rooms that housed the equipment had six work stations for the electricians. ▼



NEW: The Safpatch® panel, master control console and ten-scene preset equipment is all in just one of the old rooms. Two or three operators are required. The second room is available now for other purposes. ▲



A famous old theatre, gets a new lighting control system

The City Center in New York City is one of the country's busiest commercial theatres.

Built in the 1920's as a Masonic Temple, it passed into the hands of the City of New York in 1943 for its failure to pay taxes. The municipal government, under the leadership of a progressive and arts-oriented mayor, formed a corporation to run the 2,700-seat theatre as a center for cultural activities at modest prices.

In the 26 years since its takeover by the city, the City Center has developed six performing production units. These include two ballet companies and companies for opera, drama, light opera and Gilbert & Sullivan.

But despite its need to adapt to a variety of theatrical requirements, the City Center had a lighting control system that was almost wheezing to keep pace.

Essentially, the old system depended on a series of mid-1920 mechanical resistance dimmers. . .the kind you hardly see anywhere anymore. There was of course no pre-setting of scenes. As the cues were called, six stagehands manually moved the dimmer operating levers to the approximate position indicated by the cue sheets.

Each touring company either brought in its own road boards or used the limited control capability at the City Center.

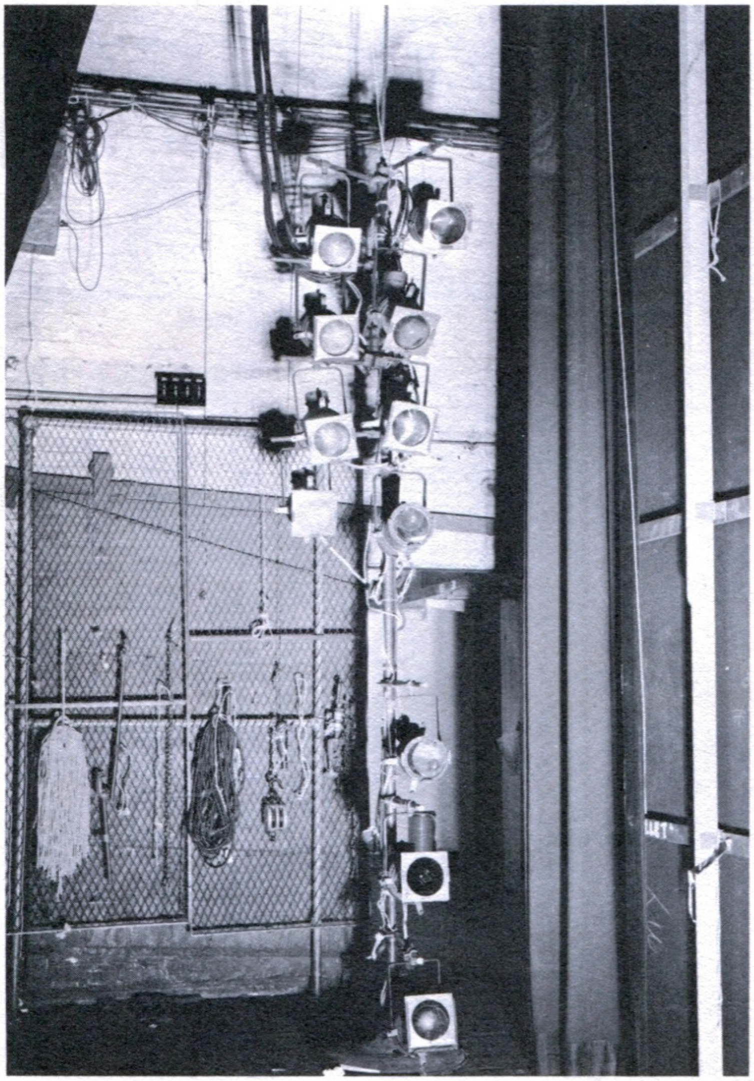
In 1968, the City Center had an opportunity to revamp its lighting system. The needs of the theatre dictated the requirements of the system:

1. **It had to be flexible.** When a theatre plays everything from ballets to dramas to operas, the system had to cope with whatever any of a number of lighting designers wanted to do.

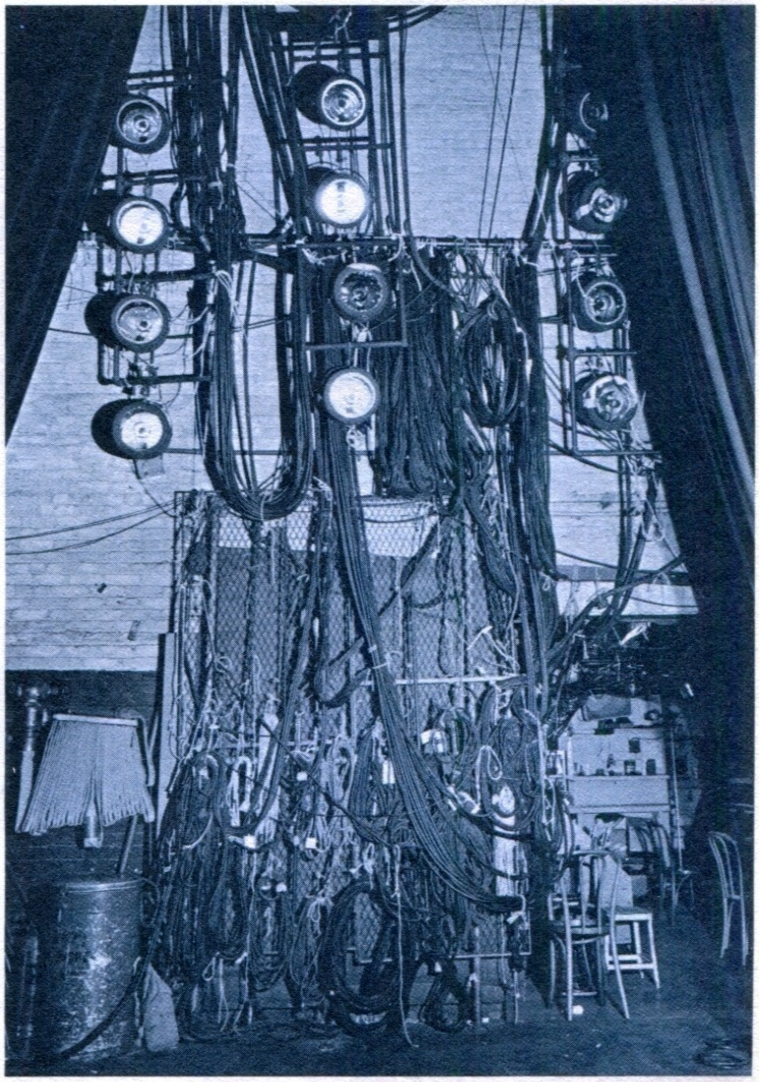
2. **It had to be efficient.** The old system needed six technicians to do anything. There was an urgent requirement to have a system work with as few as two people.

3. **It had to be easy to make lighting setups.** Since a variety of lighting designers used the theatre, the system had to be able to connect and disconnect to various lighting plots quickly.

The Kliegl Brothers system described on these pages was designed to meet those criteria. Although working drawings were not completed until mid-May, 1968, the system was completely installed and operating by Labor Day of the same year.



NEW: The almost 300 circuits behind the proscenium now feed outward from a single connector strip-compartmented ductway located 40′ over the stage at the stage left fly gallery. The ductway then carries all the circuits down to the Safpatch® panel on the stage level.



OLD: The cables you see hanging behind the lights all descended from the various circuits located over the stage, one cable per circuit. They connected individual lights with the resistance dimmers.

Master Control

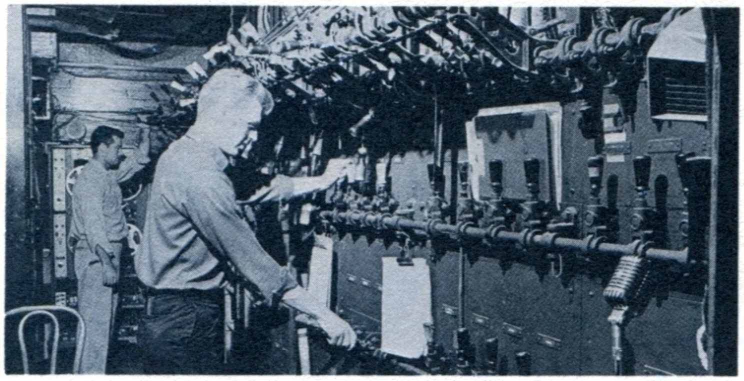
The system is operated from a master control desk located at stage left. The two pre-set consoles flank the master control operator on his left and the stage manager's desk is at his right.

The master control console itself has 100 lighting control channels. The potentiometers representing these are grouped into two rows and then numbered 1 through 50 for the lower set and 51 through 100 for the upper set. Every attempt has been made to keep all controls within easy arm reach of the seated master electrician.

Over each channel control potentiometer is a set of four rear-illuminated and color coded pushbuttons, allowing the operator to establish an "Off", "Pre-set", "Manual A" or "Manual B" mode for each control channel.

Any control channel for example, can be placed in "Preset" mode. This allows intensity readings for this channel to be set in advance on the adjacent 10 scene preset consoles, and faded into use at the proper time by the operator on the main console.

The master lighting console: at top the matrix panel; center – the 100 channel controllers and selector pushbuttons; operator's shelf – master controls and fader.



Above: The original City Center resistance dimmer board, originally designed for control of the house lights and border and foot lights.

Below: These auxiliary portable roadboards were needed for every attraction that played the City Center to supplement the house switchboard. But these roadboards were in a different room, which if nothing else made cueing more difficult.

The same control channel can be controlled independently of the preset scenes using the manual controllers directly in front of the master electrician on his own console. "Manual A" and "Manual B" modes in this case allow the operator two groupings of such independent control.

Finally, since all push-button selections are "make-before-break" the operator can use preset and manual modes simultaneously, allowing any individual channel to float into and out of preset or manual without blink or flicker.

The split fader, the preset scene fader push buttons, and Manual Masters A and B are placed at the operator's right hand, with cue sheet space directly in front of the operator and house and other auxiliary controls well over to the operator's left.

The split fader incidentally, uses the exclusive Kliegl electronic solid state circuit which assures absolutely smooth, blink-free non-dip action in all operations.

A most unique aspect of the master control console is the matrix panel which forms the uppermost portion of the console. The lighting control system actually employs a total of 162 dimmers (or dimming channels) to insure sufficient flexibility and capacity. But this main console has been deliberately limited to 100 control channels or control groupings. It is the matrix panel which forms the flexible "interface" between the 162 dimmer channels and the 100 control channels. Tiny spring reels are employed to retract the load cords representing the dimmer channels when they are not in use.

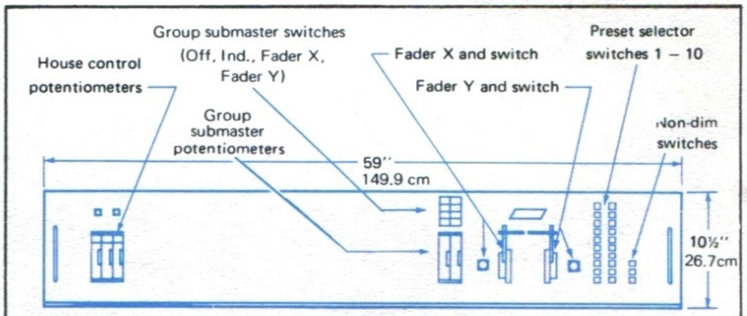

Group submaster switches
(Off, Ind., Fader X, Fader Y)
House control potentiometers
Fader X and switch
Preset selector switches 1 – 10
Fader Y and switch
Group submaster potentiometers
Non-dim switches
59''
149.9 cm
10½''
26.7cm

FIGURE 1 – Master Control Panel

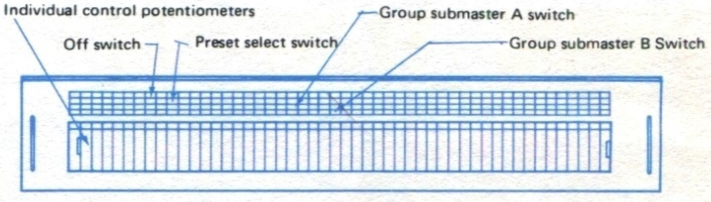


FIGURE 2 – Control Assignment Panel

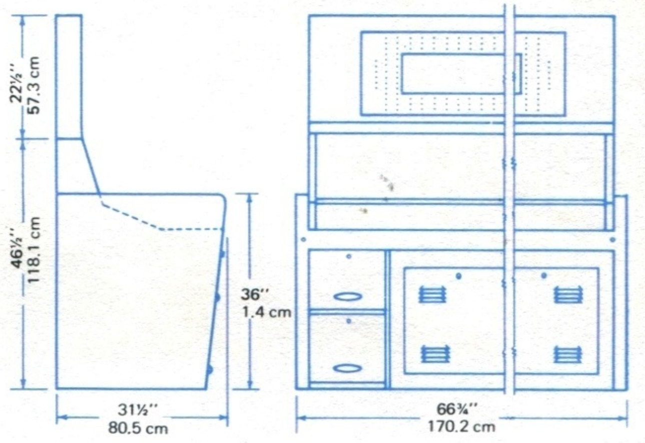


FIGURE 3 – Master Control Console

Pre-set Panels

The old system at the City Center had no presetting capability at all. As cues were called, operators moved the handles of the appropriate resistance dimmers to the predetermined intensities.

The new system offers ten scenes of presetting control arranged in two panels of five scenes each. Some productions will require the resetting of even these ten scenes a few times over.

For example, musical productions with over 150 "presets" are not uncommon. Where the presets are used over and over again within a single performance then one operator works each preset panel.

Many productions, on the other hand, are sufficiently simple and require the use of only a limited number of presets. For these productions only the master console operator and one preset panel operator are required.

Each of the two preset panels contains 100 Kliegl potentiometers (one for each channel of control) in each of its five rows, yet the panels are only 57" wide. Each plug-in potentiometer casing, although only 1" wide, contains two individual controls; e.g. the first casing carries channels 1 and 2, the next 3 and 4, and so on. Thus only fifty such dual assemblies are required for the 100 control channels in each scene of presetting. This dual potentiometer arrangement saves valuable space and makes all of the potentiometers extremely easy to reach and to set accurately.

Standard Kliegl potentiometers are used in the City Center. Each potentiometer is precise–Kliegl specs a "conformity" of ± 2% and a resistance accuracy of ± 5%. Designers working in this theatre are assured that the lighting system will deliver the intensities they have programmed.

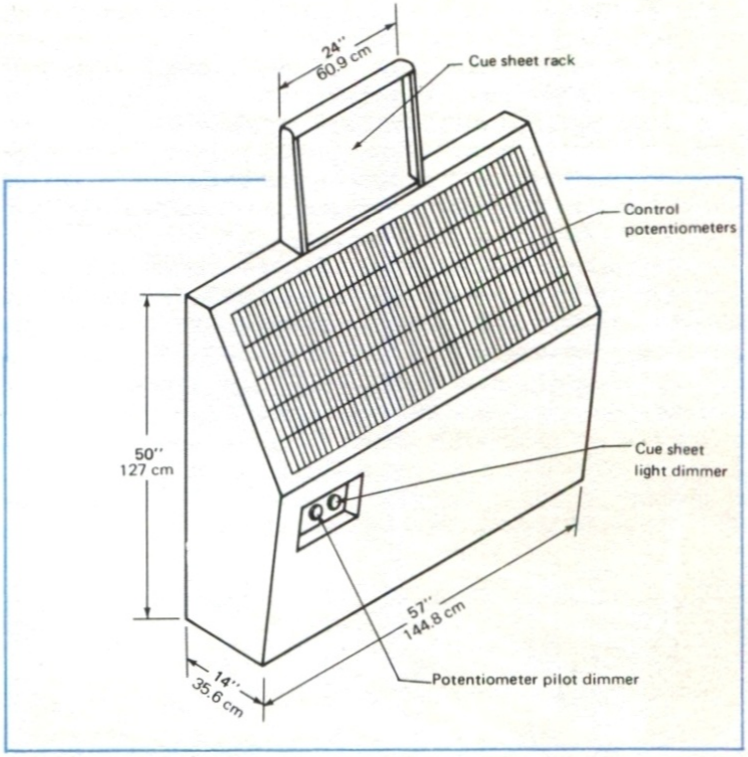
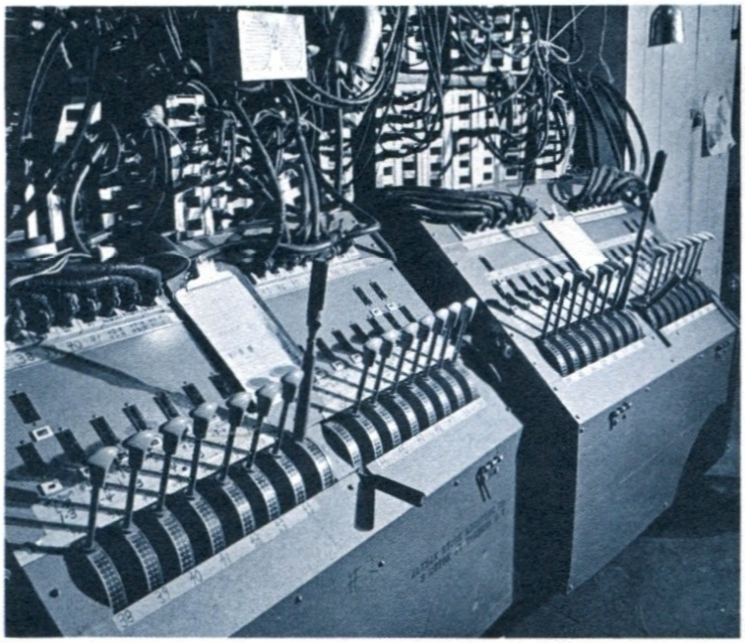
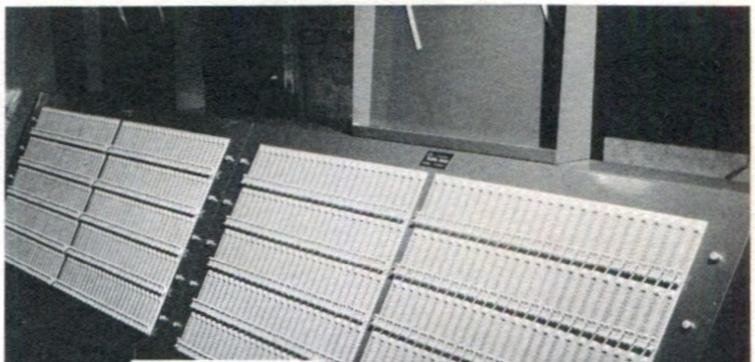


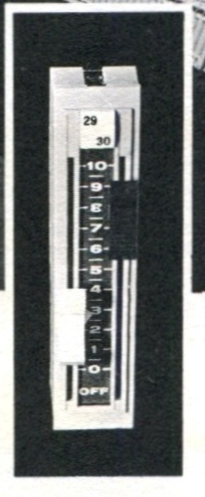
FIGURE 4 – Preset Console

OLD: Each operator controlled only one or two groups of dimmers. Even with the City Center's superb staff the best conformity and accuracy could easily run ± 20% between retakes of the same cue.



NEW: The Kliegl system: presets 5-10 at extreme left, presets 1-5 center; in right foreground, the corner of the master control console. Accuracy is helped because the presetting is done in advance, but extremely accurate repeat readings are obtained since the operators work with potentiometers that are precise to begin with.





Kliegl "dual potentiometer" – features two controls in 1" wide casing. Each control has the same scale length, dial movement and the same precision potentiometer of the individual wider controls employed on the master console.

Connecting the Circuits

One of the major failings of the old system was the difficulty in setting up a show. Each stage circuit cable, for example, had to be run from the lighting fixture, over to the stage left wall, down the wall, and then threaded through the maze of other cables into the proper dimmer receptacle. Even though cables were bundled and run in groups this system cluttered the valuable working space at the stage level.

In the new system, each lighting designer has the twin advantages of extra flexibility and simplicity.

There are 370 stage lighting circuits. Of these, 76 are tormentor, upstage booms, floor and wall pockets. There are 88 circuits in the front of the house, located in the box booms, on the first and second balcony tiers and in footlights at the front edge of the stage apron.

The balance, 206 circuits, are located over the stage in six sets of spotlight pipes and borderlight pipes. These circuits feed into a connector strip-ductway located at the stage left fly gallery over the stage.

A compartmented 24" wide duct brings all 206 over-the-stage circuits into the patch panel. This wiring technique means that no loose cable comes from the pipes to the stage floor. . .and the wiring hookup is largely set once the lights are plugged into the fly gallery strip. Thousands of feet of cable are saved along with the attendant bulk and clutter.

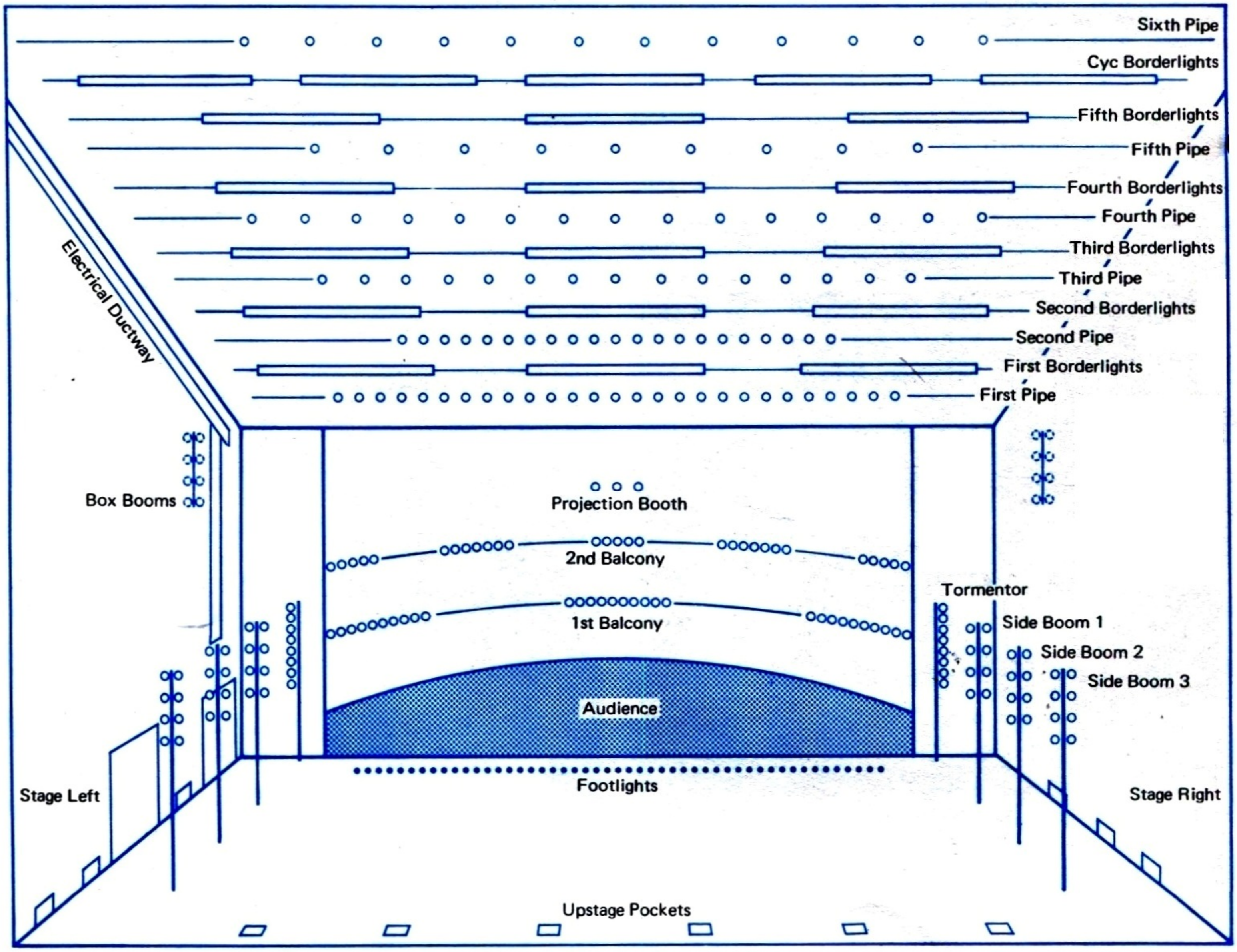
Road Company Provisions

Even with the extensive lighting system at the City Center, there will be times when a road company will prefer to bring in their own portable switchboards for which the equipment hookup and cueing is already set.

For the power supply to these roadboards the main incoming stage lighting service is tapped within the Kliegl dimmer rack and brought up into a series of fused disconnects at stage level. The portable switchboards are then temporarily connected to these switches.

To connect up the lights backstage the touring company strings its own cable from roadboard to the various light pipes, completely bypassing the patch panel.

The front-of-house circuits are a different story, however, since the NYC Electrical Code prevents stringing temporary cable in the auditorium. The road company uses the 88 existing front-of-house circuits which feed to the patch panel. At the patch panel pin plug feeds and receptacles have been incorporated for these circuits so that the road company can feed the front-of-house circuits from its own switchboards interrupting the normal feed arrangements through the patch panel.



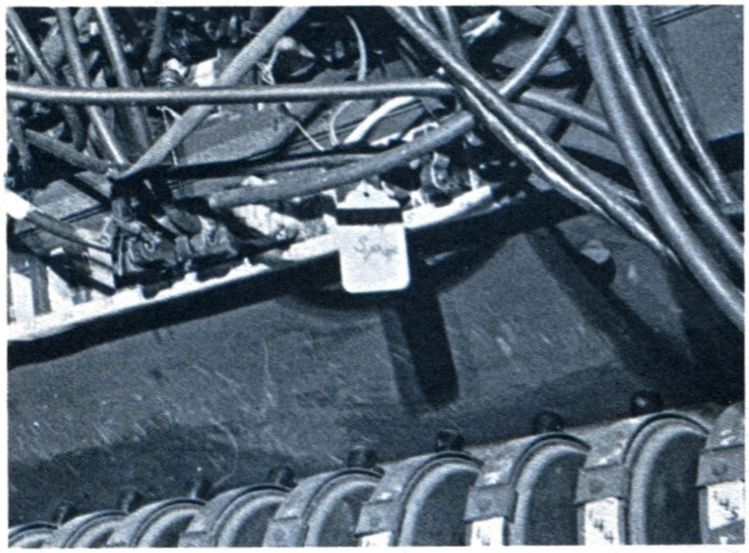
"Patching" the Show

The Safpatch® panel is located on stage left forming an aisle with the control consoles (see plan view – page 2). The purpose of this device is to connect the stage lighting circuits to the control system's dimmers. The allocation of specific stage circuits to specific dimmers will vary widely depending on the production, and hence the "setup" of each production may require extensive replugging on the patch panel. For this reason the Consultant placed the patch panel in the immediate area of the control consoles thus assuring rapid access by the system operators when required.

There are 360 20 amp circuits and ten 50 amp circuits capable of being grouped onto 162 dimmers and three non-dims. Patching is done by plugging the desired stage circuit "plug" into the desired dimmer output receptacle. The Safpatch® system is of the automatic cold patch type, and like the other power components in a Kliegl system bears the appropriate Underwriter's Laboratories designations.

The 88 front-of-the-house circuits (first and second balcony, box booms and footlights) are all grouped together at the top of the panel, and as noted earlier a simple "front-of-house" pin connector patching system is incorporated so that these circuits can be directly connected to outside traveling company roadboards whenever this is required.

"Patching" into the roadboards in the old system resulted in much confusion and tangle of cable.



"Patching" in the new system: each dimmer has its own receptacle grouping. Each receptacle in this group, and thus the circuit patched into it is individually protected with its own secondary circuit breaker.

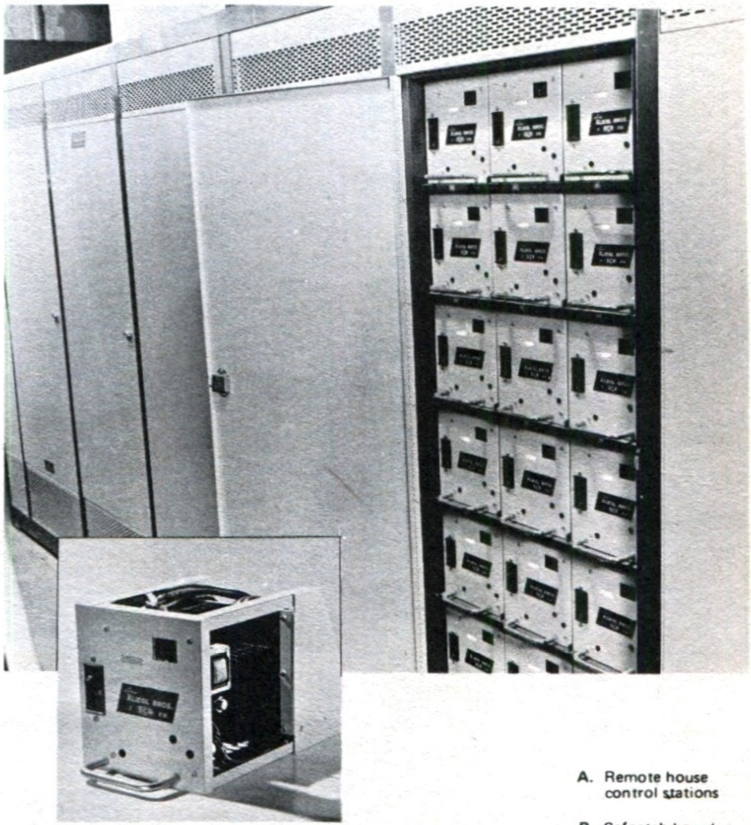
The Dimmer Bank

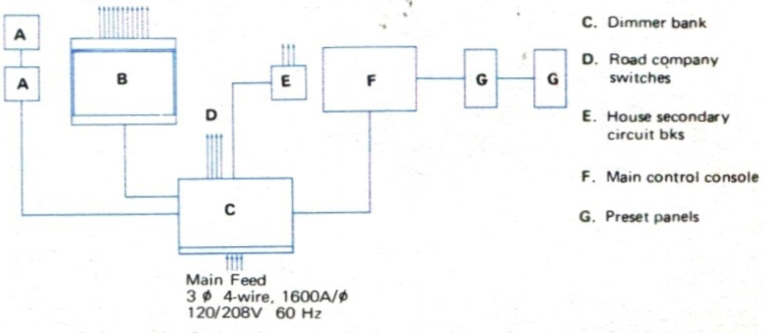
The power feed for the City Center dimming system is 1600 amperes 3 phase 4 wire 120/208 volt. A small part of this service is used for house lights. Kliegl R-66 SCR Dimmers® are used throughout the system. The dimmer bank contains 144 dimmers with 7Kw rating, three 7Kw non-dim units and 21 dimmers with 12Kw rating. (Three of these latter are house light dimmers.)

The dimmer racks and associated power distribution elements are placed in an island type back-to-back arrangement within the switchgear room one level below stage, and almost directly underneath the patch panel. This arrangement makes the power distribution system very direct – incoming power service terminating adjacent to the dimmer bank, and the patch panel directly above the dimmer bank.

Kliegl's R-66 dimmer features very tight voltage regulation; a sophisticated current limiting circuit (which allows accidental dimmer overload of up to three times rating without taking the dimmer off of the line); excellent choking to prevent audio buzz and lamp noise; and, of course, precise repeatable setting and fast response to control handle movements.

Dimmer rack with door opened to show modular arrangement of 18 plug in dimmers per compartment. Kliegl plug-in SCR dimmer®. "Package" size for up to 12Kw at 120 volts (or 24 Kw at 220 volts) is only 7" wide X 7½" high X 11" deep.





Schematic flow diagram of power and control for the City Center Lighting Control System.

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Other publications in this series include "The Kliegl Brothers Lighting System at the Santa Fe Opera"

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